REMARKS

Claims 3, 12, and 24 have been canceled. Claims 7 through 10, 19 through 22, 27, and 31 have been amended. Claims 1, 2, 4 through 11, 13 through 23, and 25 through 32 remain in the application.

Claims 27 and 31 were objected to because of an informality in these claims. Applicants respectfully traverse this objection.

Claims 27 and 31 have been amended in accordance with the Examiner' s suggestions on page 3 of the Office Action to clarify these claims. It is respectfully submitted that claims 27 and 31 are allowable over the objection.

Claims 25, 26, 28, 29, 30, and 32 have been allowed.

Claims 7 through 11 and 19 through 23 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 27 and 31 were indicated as being allowable if the objections described in paragraph 5 are overcome.

Accordingly, claims 7 through 10 and 19 through 22 have been amended and rewritten in independent form to include the limitations of the base claim and any necessary supporting intervening claims. Claims 27 and 31 have been amended to overcome the objections. It is respectfully submitted that claims 7 through 11, 19 through 23, 27, and 31 are in a condition for allowance, which allowance is solicited.

Claims 1 through 6 and 13 through 18 were rejected under 35 U.S.C. § 103 as being unpatentable over Sakaguchi et al. (U.S. Patent No. 5,946,479) in view of Miller et al. (U.S. Patent No. 6,045,310) and further in view of McCreery (U.S. Patent No. 4,359,206) and Zicheng et al. ("A study of helical coordinate system and helical slow wave structure", IEEE 1998).

U.S. Patent No. 5,946,479 to Sakaguchi et al. discloses a method and device for generating mesh for use in numerical analysis. Several methods, such as a finite differential method, a finite element method, a boundary element method, or an integral equation method, can be used for performing numerical analysis. The majority of these methods involve the generation of mesh for the object to be analyzed and, when necessary, the space surrounding it. However, when a mesh is generated using three-dimensional mesh elements, it is necessary to generate the mesh elements of each block with consideration to the compatibility of mesh elements with those in adjacent blocks. Sakaguchi et al. does not disclose generating a finite element mesh for a threaded fastener and joining structure assembly. Sakaguchi et al. also does not disclose a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

U.S. Patent No. 6,045,310 to Miller et al. discloses a composite fastener for use in high temperature environments. A composite fastener 40 may include a metal coupling 90 attachment structure. The metal coupling 90 is a metal sleeve with threads on an external surface to engage an externally threaded device. The addition of the threaded metal sleeve 90 converts the fastener to a threaded fastener without the limitations of previous threaded composite fasteners. The threaded metal sleeve has a bore that receives the peripheral engagement surface of the sleeve. Finite element representations 300, 310 of a liner and a fastener respectively, may be used to analyze the design of the fastener and the liner in regard to thermal and structural perspectives. In addition, the representations 300, 310 may be used to optimize the designs for acoustic and thermal loading. Finite element models may also be used to analyze the stress in the

fastener in regard to boundary conditions and manufacturing tolerances. Miller et al. does not disclose a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

U.S. Patent No. 4,359,206 to McCreery et al. discloses a severe duty hydraulic cylinder with continuously effective locking device. A safety system is provided by machining a helix or single groove around an exterior surface of a guide cylinder over a predetermined length thereof. A rotating locking nut including a thread to match the groove is placed around the guide cylinder and is capable of moving relative to the guide cylinder through a distance corresponding to the required travel of the hydraulic cylinder. While the operation of safety attachment 68 has been described as the rotation of locking nut 72 containing a helical thread, it is possible to provide a rotating motion to guide cylinder 40 and ram 16 during the raising stroke and utilize a locking nut containing a straight key rather than helical thread 74. McCreery et al. does not disclose a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

Zicheng et al. discloses a study on helical coordinate system and helical slow wave structure. Helical coordinate system (HCS) is developed to lay a profound ground to treat helical slow wave structure. HCS must have a family of coordinate curves to coincide with the helix. Zicheng et al. does not disclose a mesh model of a threaded fastener and joining structure

assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

In contradistinction, claim 1 claims the present invention as a system of generating a finite element mesh for a threaded fastener and joining structure assembly including a computer system, wherein the computer system includes a memory, a processor, an input device and a display device. The system also includes a mesh model of the threaded fastener and joining structure assembly generated on the computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates. Claim 13 is similar to claim 1 and is directed to a method.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that "[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703,

705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) ("In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.")

None of the references cited, either alone or in combination with each other, teaches or suggests the claimed invention of claims 1 and 13. Specifically, Sakaguchi et al. '479 merely discloses a method and device for generating mesh for use in numerical analysis in which it is necessary to generate mesh elements of each block with consideration to the compatibility of mesh elements with those in adjacent blocks. Sakaguchi et al. '479 lacks generating a finite element mesh for a threaded fastener and joining structure assembly. Sakaguchi et al. '479 also lacks a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

Miller et al. '310 merely discloses a composite fastener for use in high temperature environments that includes a metal coupling with threads on an external surface to engage an externally threaded device and finite element representations of a liner and a fastener may be used to analyze the design of the fastener and the liner in regard to thermal and structural perspectives. Miller et al. '310 lacks a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

McCreery et al. '206 merely discloses a severe duty hydraulic cylinder with continuously effective locking device provided by machining a helix or single groove around an exterior surface of a guide cylinder over a predetermined length thereof. McCreery et al. '206 lacks a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates.

Zicheng et al. merely discloses a study on helical coordinate system and helical slow wave structure in which a helical coordinate system (HCS) must have a family of coordinate curves to coincide with the helix. Zicheng et al. lacks a mesh model of a threaded fastener and joining structure assembly generated on a computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates. As such, there is no suggestion or motivation in the art to combine Sakaguchi et al. '479, Miller et al. '310, McCreery et al. '206, and Zicheng et al. together.

The present invention sets forth a unique and non-obvious combination of a system and method of generating a finite element mesh for a threaded fastener and joining structure that produces a good quality three dimensional mesh while considerably reducing design time and related expenses. The references, if combinable, fail to teach or suggest the combination of a method and system of generating a finite element mesh for a threaded fastener and joining structure assembly including a computer system, wherein the computer system includes a memory, a processor, an input device and a display device, and a mesh model of the

threaded fastener and joining structure assembly generated on the computer system wherein nodes and elements for each non-threaded portion of the threaded fastener and joining structure assembly are created using cylindrical coordinates and nodes and elements for each threaded portion of the threaded fastener and joining structure assembly are created using helical coordinates as claimed by Applicants.

Further, the CAFC has held that "[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification". In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants' invention. The Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 1 and 13 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejection of claims 1 through 6 and 13 through 18 is improper. Therefore, it is respectfully submitted that claims 1 through 6 and 13 through 18 are allowable over the rejection under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance, which allowance is solicited.

Respectfully submitted,

By: _____

Daniel H. Bliss
Reg. No. 32,398

BLISS McGLYNN, P.C.
2075 West Big Beaver Road, Suite 600
Troy, Michigan 48084
(248) 649-6090

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